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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Application Number: 10/633,935
Filing Date: August 04, 2003
Appellant(s): MALMIN, RONALD E.

Vincent M. DeLuca
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed August 9, 2006 appealing from the Office action mailed January 6, 2006. The brief is timely filed in response to the Notification of Non-Complaint Appeal Brief (37 CFR 1.47) mailed July 31, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US006762413B2	ZENG	7-2004
US3688113A	MIRALDI	8-1972
US006521894B1	IWANCZYK ET AL.	2-2003

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 2, 4, 22, 5, 7-10, 21, 11, 13-15, 18, 23-25, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zeng (US006762413B2) in view of Miraldi (US003688113A).

With respect to independent claim 1, Zeng discloses a gamma camera **22** (Fig. **2A**, column 5, lines 24-55) comprising a plurality of radiation sensitive detector elements **106** (Fig. **4**), at least one solid-state photodetector coupled to the elements **106** (column 7, lines 34-35), and a slat collimator **100** including a plurality of elongated slats **102** for collimating each of the plurality of elements **106** to receive gamma photons (column 1, lines 13-14) in only a single dimension (along dimension $\mathbf{W}_y$). The radiation sensitive detector elements **106** in the gamma camera **22** of Zeng are made of scintillating material (column 7, lines 31-35) and are elongated (dimension $\mathbf{C}_y$ of the detector elements **106** is substantially the same as the dimension $\mathbf{W}_y$ of the slats **102**, column 7, lines 45-48) and thus constitute a "bar" within the meaning of the claim, arranged in a stack configuration (Fig. 4). Zeng leaves the specific arrangement of the optical communication of the appropriate photodetector to the stack of elongated bar detector strips **106** as a choice within the ordinary skill in the art (column 7, lines 34-35) since no explicit description or illustration of such optical communication is included. There are only six sides, however, to a parallelepiped bar as shown by Zeng at **106** (or to a stack thereof) and those of ordinary skill in the art recognize that there is no opportunity to couple a photodetector to the incident radiation side of the stack (because this would attenuate the radiation traveling towards the scintillator) or to the sides of the strips facing the collimator slats (because this would increase the slat spacing **G** and reduce the resolution). Miraldi discloses a gamma camera **12** (column 4, lines 1-2) comprising a plurality of scintillation crystals **86** (column 5, lines 15-19), at least one photodetector **96, 98** coupled to at least one end of each crystal **86** normal to its elongated dimension (Fig. 7), and a collimator **88** with a plurality of channels **94** for collimating each of the plurality of crystals **86** to receive gamma photons in only a single dimension.

Thus Miraldi shows (Fig. **7**) that optical communication between an elongated bar detector strip made of scintillating material **86** and a photodetector **96, 98** in a gamma camera by coupling of the photodetector to an end of the bar detector strip (and thus normal to the elongated dimension) has long been known. In view of the good light collection from a long bar strip with end-coupled photodetectors (with reflective coating **92** as disclosed by Miraldi to guide light to the ends, column 6, lines 2-5), it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the gamma camera of Zeng to specify that the photodetectors in the gamma camera **22** were coupled to at least one end of the stack of elongated bar detector strips **106**.

With respect to dependent claim 2, Zeng discloses that each elongated bar detector strip **106** is in optical communication with an appropriate photodetector (column 7, lines 31-35). Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made, in view of the suggestion of Miraldi, to modify the gamma camera **22** of Zeng to further comprise a plurality of photodetectors each coupled to at least one end of each elongated bar detector strip **106** of the stack.

With respect to dependent claim 4, Zeng discloses that the photodetectors are photodiodes (column 7, line 35).

With respect to dependent claim 22, Miraldi suggests photodetectors **96, 98** are coupled to both ends of the scintillation crystal **86**. It would have been obvious to one of ordinary skill in the art at the time the invention was made to couple each of the elongated bar detector strips **106** in the stack of the gamma camera **22** of Zeng to a photodetector at both ends as suggested by Miraldi in order to avoid an artifact based on distance of the scintillation event from the one photodetector.

With respect to dependent claim 5, Zeng discloses that the elongated bar detector strips **106** are formed of CsI (column 7, line 34).

With respect to dependent claim 7, Zeng discloses each elongated bar detector strip **106** is located between individual slats **102** of the slat collimator **100** (column 7, lines 23-26).

With respect to dependent claim 8, each of the individual slats **102** in the gamma camera **22** of Zeng has a length $\mathbf{W}_y$ matching the length $\mathbf{C}_y$ of the elongated bar detector strips **106** (column 7, lines 45-48).

With respect to dependent claim 9, the slat collimator **100** in the gamma camera **22** of Zeng is mounted adjacent to the plurality of elongated bar detector strips **106** (Fig. **4**).

With respect to dependent claim 10, see the explanation of the rejection against claim 8, and further the spacing **G** between slats **102** of the slat collimator **100** in the gamma camera **22** of Zeng (Fig. **4**) matches the dimension $\mathbf{C}_x$ of the elongated bar detector strips **106** (compare with Fig. **8** where every other slat **102** is omitted and $2\mathbf{C}_x=2\mathbf{G}$).

With respect to dependent claim 21, Miraldi suggests photodetectors **96**, **98** are coupled to both ends of the scintillation crystal **86**. It would have been obvious to one of ordinary skill in the art at the time the invention was made to couple the stack of elongated bar detector strips **106** in the gamma camera **22** of Zeng to at least a second photodetector at a second end of the stack as suggested by Miraldi in order to avoid an artifact based on distance of the scintillation event from the one photodetector.

With respect to independent claim 11, which differs from independent claim 1 in not requiring a "stack configuration" arrangement or a "solid-state" photodetector, Zeng discloses a gamma camera **22** (Fig. **2A**, column 5, lines 24-55) comprising a plurality of radiation sensitive detector elements **106** (Fig. **4**), at least one photodetector coupled to the elements **106** (column 7, lines 34-35), and a slat collimator **100** including a plurality of elongated slats **102** for collimating each of the plurality of elements **106** to receive gamma photons (column 1, lines 13-14) in only a single

dimension (along dimension **W_y**). The radiation sensitive detector elements **106** in the gamma camera **22** of Zeng are made of scintillating material (column 7, lines 31-35) and are elongated (dimension **C_y** of the detector elements **106** is substantially the same as the dimension **W_y** of the slats **102**, column 7, lines 45-48) and thus constitute a "bar" within the meaning of the claim (Fig. 4). Zeng leaves the specific arrangement of the optical communication of the appropriate photodetector to the stack of elongated bar detector strips **106** as a choice within the ordinary skill in the art (column 7, lines 34-35) since no explicit description or illustration of such optical communication is included. There are only six sides, however, to a parallelepiped bar as shown by Zeng at **106** (or to a stack thereof) and those of ordinary skill in the art recognize that there is no opportunity to couple a photodetector to the incident radiation side of the stack (because this would attenuate the radiation traveling towards the scintillator) or to the sides of the strips facing the collimator slats (because this would increase the slat spacing **G** and reduce the resolution). Miraldi discloses a gamma camera **12** (column 4, lines 1-2) comprising a plurality of scintillation crystals **86** (column 5, lines 15-19), at least one photodetector **96, 98** coupled to at least one end of each crystal **86** normal to its elongated dimension (Fig. 7), and a collimator **88** with a plurality of channels **94** for collimating each of the plurality of crystals **86** to receive gamma photons in only a single dimension. Thus Miraldi shows (Fig. 7) that optical communication between an elongated bar detector strip made of scintillating material **86** and a photodetector **96, 98** in a gamma camera by coupling of the photodetector to an end of the bar detector strip (and thus normal to the elongated dimension) has long been known. In view of the good light collection from a long bar strip with end-coupled photodetectors (with reflective coating **92** as disclosed by Miraldi to guide light to the ends, column 6, lines 2-5), it would have been obvious to one of ordinary skill in the art at the time the invention

was made to modify the gamma camera of Zeng to specify that the photodetectors in the gamma camera **22** were coupled to at least one end of the stack of elongated bar detector strips **106**.

<u>Comparison of Claim 11, with claim limitations compared feature-by-feature with the prior art, aligning the language of the claim with references to the specific columns, line numbers, drawings, and reference symbols, and including quotations from the prior art</u>

11. A gamma camera, comprising:	Zeng is a "gamma camera" (column 1, lines 12-13); Miraldi is a "camera" (column 2, lines 60-61) which detects "gamma" rays (column 4, lines 1-2).
a plurality of elongated bar detector strips made of scintillating material;	Zeng discloses a plurality of detector elements **106** (Fig. 4) that are elongated bar strips (**C_y** is substantially the same as **W_y**, column 7, lines 45-48) made of scintillating material (column 7, lines 32-34); Miraldi discloses a scintillator crystal **86** which is an elongated bar (Fig. **6**) used in the plural (column 5, lines 15-19).
at least one photodetector coupled to an end of each of said bar detector strips normal to said elongated dimension;	Zeng discloses that elements **106** are "in optical communication with a photo diode or other appropriate photodetector" (column 7, lines 32-35); Miraldi discloses photodetectors **96, 98** (Fig. **7**) coupled to an end of one of the plurality of scintillation crystals **86**, the ends which are normal to the elongated dimension (since a scintillation crystal **86** is used for each collimator channel **94**, column 5, lines 15-19, photodetectors would be attached to the ends of each such crystal).
and a slat collimator including a plurality of elongated slats, for collimating each of said plurality of bar detector strips to receive gamma photons in only a single dimension.	Zeng discloses (Fig. 4) a collimator **100** including a plurality of elongated slats **102** for collimating each of the plurality of elongated bar detector strips **106** to receive gamma photons in only a single dimension, along dimension **W_y** (a one dimensional slat collimator, column 6, lines 58-60); Miraldi discloses a collimator (Fig. **7**) including a plurality of sections **88** (column 6, lines 7-8) for collimating each scintillation crystal **86** to receive gamma photons only along the

dimension parallel to focal line **92** (column 6, lines 9-11).

With respect to dependent claim 13, Zeng discloses that the photodetectors are photodiodes.

With respect to dependent claim 14, Zeng discloses that the elongated bar detector strips **106** are formed of CsI (column 7, line 34).

With respect to dependent claim 15, Zeng discloses each elongated bar detector strip **106** is located between individual slats **102** of the slat collimator **100** (column 7, lines 23-26).

With respect to dependent claim 18, each of the individual slats **102** in the gamma camera **22** of Zeng has a length $\mathbf{W}_y$ matching the length $\mathbf{C}_y$ of the elongated bar detector strips **106** (column 7, lines 45-48).

With respect to dependent claim 23, the slat collimator **100** in the gamma camera **22** of Zeng is mounted adjacent to the plurality of elongated bar detector strips **106** (Fig. **4**).

With respect to dependent claim 24, see the explanation of the rejection against claim 18, and further the spacing **G** between slats **102** of the slat collimator **100** in the gamma camera **22** of Zeng (Fig. 4) matches the dimension $\mathbf{C}_x$ of the elongated bar detector strips **106** (compare with Fig. 8 where every other slat **102** is omitted and $2\mathbf{C}_x=2\mathbf{G}$).

With respect to dependent claim 25, Miraldi suggests photodetectors **96, 98** are coupled to both ends of the scintillation crystal **86**. It would have been obvious to one of ordinary skill in the art at the time the invention was made to couple each of the elongated bar detector strips **106** in the gamma camera **22** of Zeng to a photodetector at both ends as suggested by Miraldi in order to avoid an artifact based on distance of the scintillation event from the one photodetector.

With respect to independent claim 19, Zeng discloses a method of obtaining tomographic images (column 1, lines 12-13) of an object **200** (Fig. **6**) corresponding to the illustrated gamma

camera **B** (Fig. **1**) which would comprise the steps of obtaining a plurality of sets of planar integral scintillation event data from the object **200** at a plurality of azimuth angles (column 8, lines 23-34) of a rotating scintillation detector (*e.g.*, Fig. **4** and column 7, lines 31-35) for each of a plurality of gantry angles of a gamma camera **22** (column 8, lines 6-21) and reconstructing the plurality of sets of planar integral scintillation event data to form a tomographic image of the object **200** (column 8, lines 43-56). The radiation sensitive detector elements **106** in the gamma camera **22** of Zeng are made of scintillating material (column 7, lines 31-35) and are elongated (dimension $\mathbf{C}_y$ of the detector elements **106** is substantially the same as the dimension $\mathbf{W}_y$ of the slats **102**, column 7, lines 45-48) and thus constitute a "bar" within the meaning of the claim (Fig. **4**). The gamma camera **22** of Zeng further comprises at least one photodetector coupled to each elongated bar detector strip **106** (column 7, lines 34-35) and a slat collimator **100** including a plurality of elongated slats **102** for collimating each of the plurality of elongated bar detector strips **106** to receive gamma photons (column 1, lines 13-14) in only a single dimension (along dimension $\mathbf{W}_y$). Zeng leaves the specific arrangement of the optical communication of the appropriate photodetector to the stack of elongated bar detector strips **106** as a choice within the ordinary skill in the art (column 7, lines 34-35) since no explicit description or illustration of such optical communication is included. There are only six sides, however, to a parallelepiped bar as shown by Zeng at **106** (or to a stack thereof) and those of ordinary skill in the art recognize that there is no opportunity to couple a photodetector to the incident radiation side of the stack (because this would attenuate the radiation traveling towards the scintillator) or to the sides of the strips facing the collimator slats (because this would increase the slat spacing **G** and reduce the resolution). Miraldi discloses a gamma camera **12** (column 4, lines 1-2) comprising a plurality of scintillation crystals **86** (column 5, lines 15-19), at least one photodetector **96, 98** coupled to at least one end of each crystal **86** normal to its elongated

dimension (Fig. **7**), and a collimator **88** with a plurality of channels **94** for collimating each of the plurality of crystals **86** to receive gamma photons in only a single dimension. Thus Miraldi shows (Fig. **7**) that optical communication between an elongated bar detector strip made of scintillating material **86** and a photodetector **96**, **98** in a gamma camera by coupling of the photodetector to an end of the bar detector strip (and thus normal to the elongated dimension) has long been known. In view of the good light collection from a long bar strip with end-coupled photodetectors (with reflective coating **92** as disclosed by Miraldi to guide light to the ends, column 6, lines 2-5), it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Zeng to specify that the photodetectors in the gamma camera **22** were coupled to at least one end of the elongated bar detector strips **106**.

Claims 3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zeng (US006762413B2) and Miraldi (US003688113A) as applied to claims 2 and 11 above, and further in view of Iwanczyk *et al.* (US006521894B1).

With respect to dependent claims 3 and 12, the photodetectors in the gamma camera suggested by Zeng and Miraldi are "appropriate" (column 7, line 35). Iwanczyk *et al.* discloses that silicon drift detectors **11** (Fig. **1**) are an appropriate photodetector for coupling to a scintillator **37** in a gamma detector **10**, especially to a CsI scintillator **53** (Fig. **4B**) shaped as a rod. In view of the effective performance of silicon drift detectors in coupling to an elongated scintillation element as described by Iwanczyk *et al.*, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the gamma camera **22** suggested by Zeng and Miraldi to specify that the appropriate photodetectors coupled to the stack of elongated bar detector strips **106** (or to the strips themselves) was of the silicon drift detector type.

(10) Response to Argument

<u>**With respect to the argument that "The Rejection of Claims 1, 2, 4, 5, 7-11, 13-15, 18, 19, and 21-25 Is Improper"**</u>

Appellant states that "Miraldi is not concerned with multiple scintillation elements located between multiple slats" and emphasizes the disclosure of "a single detector 12" and "a rectangular scintillation crystal 86" (page 9). While this is a piecemeal argument since these elements (multiple scintillation elements, multiple slats) are unequivocally disclosed by Zeng and thus their presence is not required in Miraldi, nevertheless, Miraldi discloses multiple scintillation elements closely aligned with the individual channels in the collimator. As plainly evident to one of ordinary skill in the art considering the disclosure of Miraldi as a whole, each collimator channel **94** is aligned with a corresponding scintillation crystal **86**. See especially column 5, lines 15-19, discussing the embodiment of Fig. **4** which is the cross-section of the collimator shown only piecemeal in Fig. **7**: "With the use of the collimator of FIG. **4**, however, it would be necessary to use a pair of scintillation crystals for each pair of openings **50** which meets at a common focal line." Thus, Miraldi discloses a gamma camera in which a plurality (multiple) of scintillation crystals **86** are stacked, one each in close proximity with the corresponding (multiple) exit aperture of a collimator channel **50**, **51**, **52**, **53** and their mirror images. Contrary to Appellant's conclusion, then, Miraldi's solution for the coupling of a plurality of photodetectors to at least one end of a stack of elongated bar detector strips of scintillating material is relevant to the similar configuration shown by Zeng in Fig. **4**.

Appellant states that in Zeng "the slats 102 and scintillator elements 106 are located above the radiation receiving face 23" (page 10). The radiation-receiving face **23** in the gamma camera of Zeng is the collective input face of scintillator elements **106**, see for example Fig. **8**. As would be

understood by anyone with ordinary skill in the art, slats **102** extend from the radiation-receiving face **23** towards the direction from which radiation is incident so that the slats **102** may accomplish the function of collimation. See Figs. **9A** and **9B** which depict the fields of view of scintillator elements **106** in that embodiment. Thus the assertion that Zeng requires some separation between the scintillator elements and the radiation detecting face ("located above") is not based on a sound determination of the reference's disclosure.

Appellant states that in Zeng the "photodetector elements must be located within the detector head 22" on the basis that additional embodiments of Zeng, which additional embodiments (unlike the embodiment applied by the Examiner in the rejection) do not include a plurality of elongated bar detector strips, would not be able to make use of optical communication to an end of such a larger scintillator (page 9). Appellant's demand that Zeng can only teach photodetectors within the head **22** is not based on a sound determination of the reference's disclosure as discussed in the previous paragraph, and the conclusion regarding the possible locations for the photodetectors associated with the embodiment which does include the recited elements cannot be persuasive. The only specific requirements on detector head **22** taught by Zeng are that it include "a radiation receiving side or face **23** that faces the object in the receiving region; and a housing about the other detector head faces that is fabricated from a radiation attentuative material" (column 5, lines 29-32) neither of which limits the location of the photodetectors in optical communication with elements **106**.

The sequence of radiation source, collimator channel, scintillator bar, and photodetectors shown in Miraldi matches exactly the sequence required by Zeng of radiation source (field of view), collimator channel (gap 104), scintillator bar (element **106** as radiation receiving face **23** of camera **22**), and photodetectors ("the detector elements... are fabricated... in optical communication with a

photo diode or other appropriate photodetector"). The Examiner's conclusion of obviousness is accordingly based on a fair determination of the scope and contents of the prior art, an appropriate ascertainment of the differences between the prior art and the claim (Zeng does not illustrate the coupling which the reference plainly discloses, Miraldi's collimator walls are too thick to be judged as slats), and a resolution of the level of ordinary skill in the pertinent art (by reference to the good light collection suggested by Miraldi for the disclosed coupling in a similar configuration), and no objective evidence has been presented for consideration. Appellant's faulty determination of the scope and contents of the prior art as found in the brief cannot be a basis for withdrawing this conclusion.

With respect to the argument that "The Rejection of Claims 3 and 12 Is Improper"

Appellant relies on Fig. **1** of Iwanczyk *et al.* to assert that the mounting of the recited type of photodetector is "along the long dimension of a scintillator 37" (page 11). As is apparent from Fig. **4B** and column 12, line 24-31, Iwanczyk *et al.* actually teaches a rod shaped CsI scintillator **53** coupled to a silicon drift photodetector **51** in which the scintillator is elongated (a diameter of (0.5 to 20) mm, column 12, line 48, where the length would be 2×-3× the diameter, column 11, lines 65-67) and the photodetector is coupled to the end of the detector normal to its elongated dimension (length). Iwanczyk *et al.* need not teach what is already shown by Zeng and Miraldi, but Appellant's determination of the scope and contents of the prior art is again faulty.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

(12) Conclusion

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Constantine Hannaher
Primary Examiner

Conferees:

David P. Porta
Drew A. Dunn